Clim. Past Discuss.,
https://doi.org/10.5194/cp-2019-150-RC1, 2020

Climate of the Past Discussions

Interactive comment on "Estimating the timescale-dependent uncertainty of paleoclimate records – a spectral approach. Part I: Theoretical concept" *by* Torben Kunz et al.

Anonymous Referee #1

Received and published: 13 March 2020

Since I am not necessarily familiar with this field, I cannot evaluate scientific significance. However, as far as I have read, this paper is mathematically rigorous and well-written. I have not yet completely checked the entire manuscript. Since the deadline has come, I am listing some minor points which I've noticed for now. Maybe I will add some comments later.

1. 3rd paragraph in Section 1: Scale-dependent correlations could be treated by the Gaussian process model (e.g., Rasmussen and Williams, 2006), which is also known as the kriging model in spatial statistics. It might be helpful to compare the proposed spectral approach with the Gaussian process approach if possible.

Printer-friendly version

Discussion paper

2. It would be convenient if the definition of the function f_s is displayed on a separate line because this function is referred to later.

3. The definition of the operator '$*$', which is used in Eq. (4), is missing, although I understand it normally denotes convolution.

4. The meaning of the superscript (j) in Eq. (5) is not clarified until Eq. (9). It should explicitly be explained around Eq. (5).

5. If I understand correctly, $p(\varepsilon)$ can also be written as

$$p(\varepsilon) = \frac{1}{\tau_p \nu_c} \sum_{k=-\infty}^{\infty} \Pi(\varepsilon - k\nu_c^{-1}; \tau_p)$$

   and this form would be helpful to understand the sentence from L. 178 to L. 180. By the way, it seems to me the statement in L. 178 is not strict. In my understanding, $p(\nu_c^{-1}/2) = 0$ if $\tau_p < \nu_c^{-1}$ and $p(\nu_c^{-1}/2) = 2$ if $\tau_p = \nu_c^{-1}$. This might be fixed by modifying the definition of Π in Eq. (3).

6. The shape of the PDF in Eq.(18) seems to be quite unnatural. It might be worth considering to use another widely used PDF for cyclic variables such as the von Mises distribution if possible.

7. I do not understand what the authors mean in the sentence from L. 338–340, and I cannot follow why $C(\nu = 0) = 1$ holds.

8. L. 356–357: I would suggest this sentence should be written in an equation, and I think it could be used for deriving Eq. (49). I cannot take how Eq. (48) is used for obtaining Eq. (49).

9. Around Eq. (50), it should be recalled what $F_{X,n}$ and $W_{X,n}$ mean. It is hard to find their meaning described in Page 10 when reading Page 16.

10. I do not understand how Eqs. (11) and (12) yield Eq. (53).

11. I think Eqs. (31) and (52) are also required for obtaining Eq. (55).

12. It would be helpful to display Eq. (1) again at the beginning of Section 3.2.

13. L. 431: The definition of $Y_n^{(j)}$ is not given.

14. It would be helpful if it is explained in detail how the parameters in Table 1 are chosen. I wonder whether the parameters can be estimated on the basis of some criterion such as the cross validation error or they are given according to some standard choice. I also wonder how sensitively results can be affected by the uncertainty of the parameters.

References

Rasmussen, C. E. and Williams, C. K. I.: Gaussian processes for machine learning, the MIT Press, Cambridge, Massachusetts, 2006.

Interactive comment on Clim. Past Discuss., https://doi.org/10.5194/cp-2019-150, 2020.